

**WHAT IS CLAIMED IS:**

1. A suspension system, comprising:  
5 an axle assembly including an axle, at least a portion of the axle being made of a composite material.
2. The suspension system according to claim 1, further comprising at least two beams attached to the axle for pivoting displacement of the axle relative  
10 to a vehicle frame.
3. The suspension system according to claim 2, wherein the axle portion extends at least between the beams.
- 15 4. The suspension system according to claim 2, wherein the axle portion extends through each of the beams.
5. The suspension system according to claim 2, wherein each of the beams is bonded to the axle portion.  
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6. The suspension system according to claim 2, wherein each of the beams includes at least a composite portion.

7. The suspension system according to claim 6, wherein each of the beam composite portions is wrapped about the axle assembly.

5 8. The suspension system according to claim 6, wherein each of the beam composite portions has a generally H-shaped cross-section.

9. The suspension system according to claim 6, wherein each of the beam composite portions has a generally I-shaped cross-section.

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10. The suspension system according to claim 6, wherein each of the beam composite portions is bonded to the axle assembly.

11. The suspension system according to claim 6, wherein each of the beam composite portions is wrapped about a pivot bushing sleeve for pivoting attachment of the beam to the vehicle frame.

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12. The suspension system according to claim 6, wherein each of the beam composite portions is bonded to a beam metal end, the beam metal end including a pivot bushing sleeve for pivoting attachment of the beam to the vehicle frame.

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13. The suspension system according to claim 2, further comprising at least two metal sleeves secured exteriorly about the axle composite portion.

14. The suspension system according to claim 13, wherein each of the  
5 beams is attached to a respective one of the sleeves.

15. The suspension system according to claim 13, wherein each of the sleeves is bonded to the axle composite portion.

10 16. The suspension system according to claim 13, wherein each of the beams is welded to a respective one of the sleeves.

17. The suspension system according to claim 13, wherein the axle composite portion extends through each of the sleeves.

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18. The suspension system according to claim 13, further comprising at least two axle seats, each of the axle seats being interconnected between a respective one of the sleeves and a respective one of the beams.

20 19. The suspension system according to claim 13, further comprising at least two spindles, each of the spindles being attached to a respective one of the sleeves.

20. The suspension system according to claim 19, wherein the axle composite portion extends into each of the spindles.

5 21. The suspension system according to claim 19, wherein each of the spindles is bonded to the axle composite portion.

22. The suspension system according to claim 2, further comprising at least two axle seats, each of the axle seats being interconnected between the axle composite portion and a respective one of the beams.

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23. The suspension system according to claim 22, wherein each of the axle seats is bonded to the axle composite portion.

15 24. The suspension system according to claim 22, wherein each of the axle seats is welded to a respective one of the beams.

25. The suspension system according to claim 22, further comprising at least two spindles, each of the spindles being attached to a respective end of the axle composite portion.

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26. The suspension system according to claim 25, wherein each of the spindles is received in its respective end of the axle composite portion.

27. The suspension system according to claim 25, wherein each  
5 respective end of the axle composite portion is received in one of the spindles.

28. The suspension system according to claim 25, wherein each of the spindles is bonded to the axle composite portion.

10 29. The suspension system according to claim 25, further comprising at least two brake mountings, each of the brake mountings being attached to a respective one of the spindles.

30. A suspension system, comprising:

an axle assembly including a composite axle portion and a spindle attached to the composite axle portion.

5           31. The suspension system according to claim 30, wherein the spindle is attached to a sleeve at least partially overlying the composite axle portion.

32. The suspension system according to claim 31, wherein the spindle is welded to the sleeve.

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33. The suspension system according to claim 31, further comprising an axle seat attached to the sleeve.

34. The suspension system according to claim 33, wherein the axle seat  
15 is interconnected between the sleeve and a beam.

35. The suspension system according to claim 34, wherein the axle seat is welded to each of the sleeve and the beam.

20           36. The suspension system according to claim 30, wherein the composite axle portion is received within an interior of the spindle.

37. The suspension system according to claim 30, wherein the spindle  
is received within an interior of the composite axle portion.

38. The suspension system according to claim 30, wherein the spindle  
5 is bonded to the composite axle portion.

39. The suspension system according to claim 30, further comprising a  
brake mounting attached to the spindle.

10 40. The suspension system according to claim 30, further comprising  
an axle seat interconnected between the composite axle portion and a beam.

41. The suspension system according to claim 40, wherein the axle seat  
is welded to the beam.

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42. The suspension system according to claim 40, wherein the axle seat  
is bonded to the composite axle portion.

43. The suspension system according to claim 30, further comprising a  
20 beam attached to the axle assembly.

44. The suspension system according to claim 43, wherein the composite axle portion extends through the beam.

45. The suspension system according to claim 43, wherein the beam  
5 includes a portion made of a composite material.

46. The suspension system according to claim 45, wherein the composite beam portion has a generally H-shaped cross-section.

10 47. The suspension system according to claim 45, wherein the composite beam portion has a generally I-shaped cross-section.

48. The suspension system according to claim 45, wherein the composite beam portion is bonded to the composite axle portion.

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49. The suspension system according to claim 45, wherein the composite beam portion is wrapped about the composite axle portion.

50. The suspension system according to claim 45, wherein the beam  
20 further includes a pivot bushing sleeve.



51. The suspension system according to claim 50, wherein the composite beam portion is wrapped about the pivot bushing sleeve.

52. The suspension system according to claim 50, wherein the pivot  
5 bushing sleeve is part of a metal end of the beam, the metal end being attached to the composite beam portion, and the composite beam portion being attached to the composite axle portion.